NOTES ON THE LIFE HISTORY OF THE TOED-WINGED BEETLE *ANCHYTARSUS BICOLOR* (MELSHEIMER) (COLEOPTERA: PTILODACTYLIDAE)

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Abstract

The life history of *Anchytarsus bicolor* (Melsheimer) in Québec is described: the larvae are aquatic, feed on rotten wood, and require probably 3 years for full growth; 10 larval instars are estimated. Young larvae hatch in early August and overwinter a first time in instars II-III; the second year, they develop to instars VII-VIII and overwinter again; a third year is needed for most larvae to complete their growth, and these overwinter again before leaving the water in early June and pupating under debris along the stream banks. The adults emerge from late June to late July and are nocturnal; mating and ovipositing are thought to occur a few days after emergence.

Introduction

Anchytarsus bicolor (Melsheimer) is a rare beetle; it is nonetheless widespread, occurring from Georgia to New York (Brown 1972), and Québec (LeSage and Harper 1975). Its aquatic larvae, described by Böving and Craighead (1931), are ordinarily found on submerged decaying logs (Leech and Chandler 1956). The pupae, illustrated by Bertrand (1972), have peculiar abdominal structures known as "gin-traps" (Hinton 1946). The terrestrial adults are brown in colour and usually live near water (Leech and Sanderson 1959).

Those are nearly all the previously known facts about *A. bicolor*. The present note adds data on larval instars, growth of the larvae, pupal period, and adult emergence.

Methods

Collecting methods were described in detail in a previous work on Elmidae (LeSage 1976); they are briefly summarized here. Larvae were collected every month for 13 months using the "kick-sample" method of Hynes (1961) with two handnets (15 and 37 meshes to the cm). The growth diagram is based on measurements of the length of the pronotum in micrometric units (1 unit = 0.02 mm). Adults were obtained by hand-picking, rearing pupae, and from light trap collections.

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Sampling station

A more complete description of the sampling station can be found in LeSage (1976). The stream studied (Station 3 of LeSage 1976) is the outlet of the Lac Croche (45°59′ N; 74°00′ W), Station de Biologie de l'Université de Montréal (SBUM) at Saint-Hippolyte, Terrebonne County, Québec (width, 1-6 m and depth, 0.05-0.25 m).

The substratum is covered with decaying pieces of logs and sticks between which the larvae live.

Results and discussion

The integument of larval *A. bicolor* is rather bare in comparison with that of other dryopoid larvae, particularly elmids; in these, the number and distribution of piligerous tubercules, setae, and hairs provide good characters which when correlated with the length of the pronotum permit separation of the instars (Berthélemy and deRiols 1965; LeSage 1976). In *A. bicolor*, however, the number of setae is small and relatively constant from one instar to the next: on each tergum are 2 rows of 8 tufts of 2-5 setae; the only exception appears to be the first instar in which the setae are more numerous and distributed irregularly on the tergum. Also, in the first instar there is only 1 apical hook on each anal pseudopod (fig. 1), whereas there are 5-12 in the other instars.

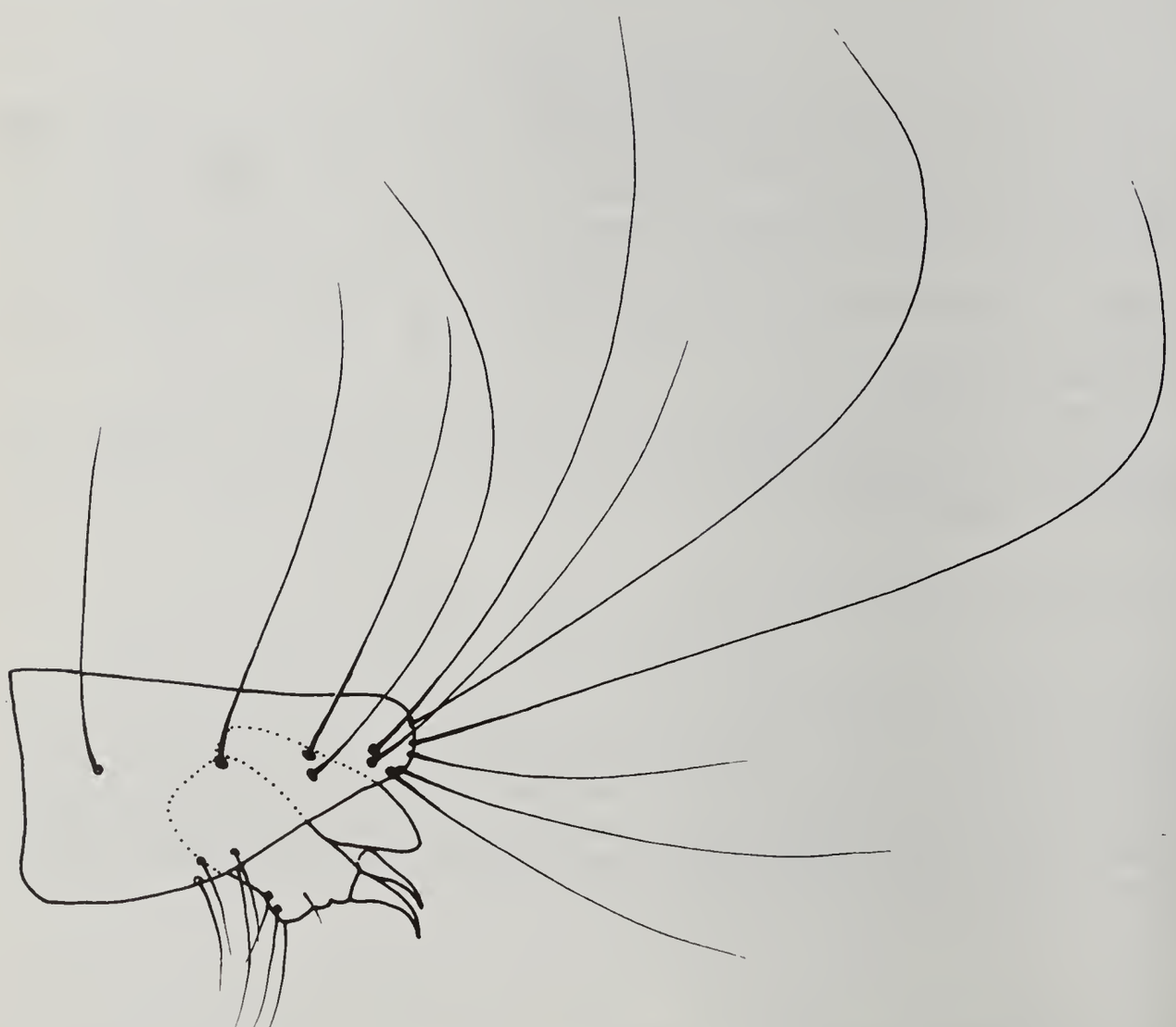

Fig. 1. Lateral view of last abdominal segment of first larval instar.

In the later instars, the more readily observable differences are the darkening pigmentation of the integument and the increasing length of the body. As preserved larvae vary greatly in total body length due to contraction and curving, the most easily measurable structure appears to be the pronotum. The size distribution of the length of this structure has previously been used with success to distinguish larval instars in the Elmidae (LeSage 1976).

The frequency distribution of the pronotal lengths (fig. 2) shows 10 more or less defined peaks which suggest the existence of 10 larval instars. These would be:

instar I, 0.18-0.20 mm (9-10 MU = micrometric units);
instar II, 0.22-0.24 mm (11-12 MU);
instar III, 0.26-0.30 mm (13-15 MU);
instar IV, 0.32-0.36 mm (16-18 MU);
instar V, 0.38-0.46 mm (19-23 MU);
instar VI, 0.48-0.56 mm (24-28 MU);
instar VII, 0.58-0.72 mm (29-36 MU);
instar VIII, 0.74-0.90 mm (37-45 MU);
instar IX, 0.92-1.12 mm (46-56 MU);
instar X, 1.14-1.42 mm (57-71 MU).

The mean lengths of the instars when set on a semi-log plot (fig. 3) indicate a classical larval growth curve.

The larvae represented in the monthly samples (fig. 4) seem to fall into 3 groups. The first group is represented by the youngest larvae (instar I) which are more numerous in early August and also by larvae of instars II-III during the following fall and winter. The second group contains the larvae of instars III-VIII: instar III occurs mainly in spring and early

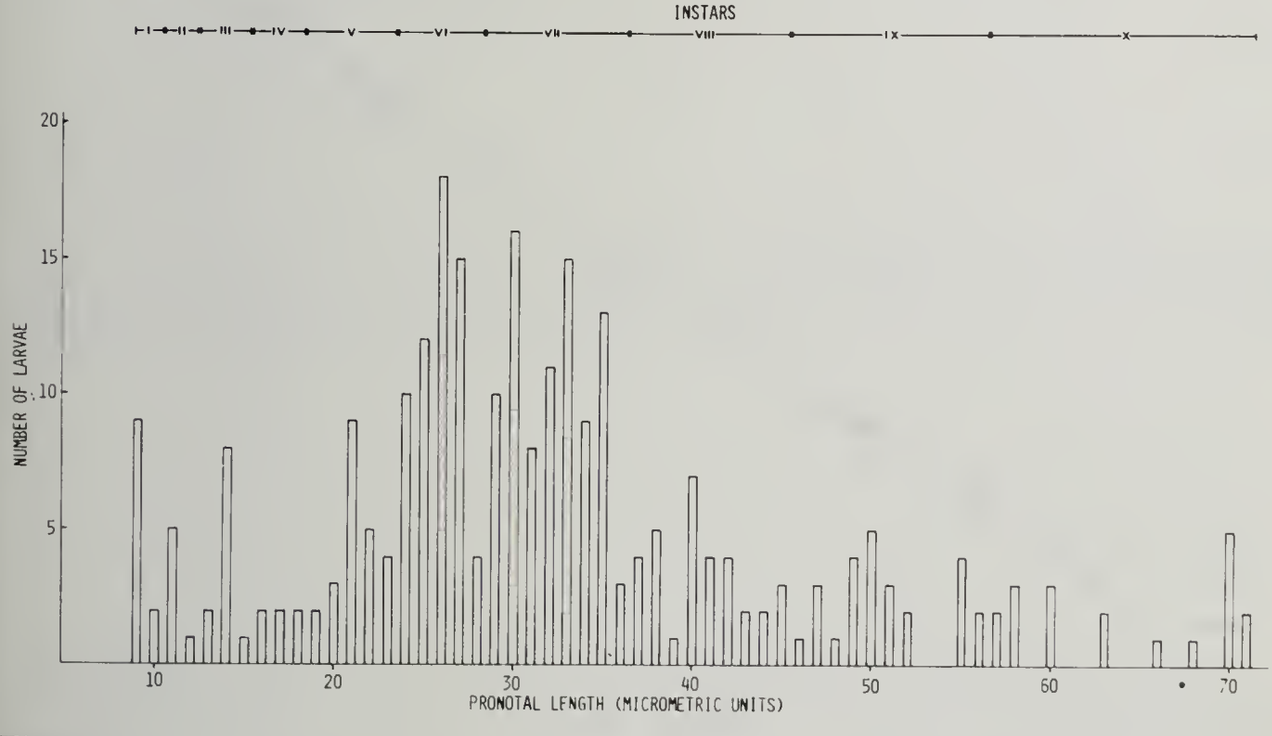

Fig. 2. Frequency distribution of larval pronotal lengths (total number of larvae 278).

summer; growth from instar III to instar VIII is completed from May to September. Throughout the winter months, the relative proportions of the instars remain constant. The larvae of instars VIII-X, the third group, are present throughout the year, but always in small numbers.

These data suggest that most larvae probably require 3 years to complete their growth, though some individual larvae may be able to emerge after 2 years. The small number of large larvae in the samples does not allow a more definite conclusion.

Larval growth of *A. bicolor* is thus very similar to that of some elmids, particularly *Stenelmis crenata* (Say) which also seems to grow for 3 years (LeSage 1976).

Stomach contents of the larvae indicate that they are entirely xylophagous, confirming earlier reports (Leech and Chandler 1956; Bertrand 1972).

We have only 1 record of pupae, on June 17, 1975. However, this sample is very interesting as 4 pupae were found together with 20 full-grown larvae; these larvae when placed in the laboratory on wet sand pupated the next day and all had emerged as adults within 1 week. Before pupating, the larvae lie on their side and assume a comma-shaped position; pupation took place in a pupal chamber built within decaying vegetal materials in cracks of a big rock on the edge of the stream.

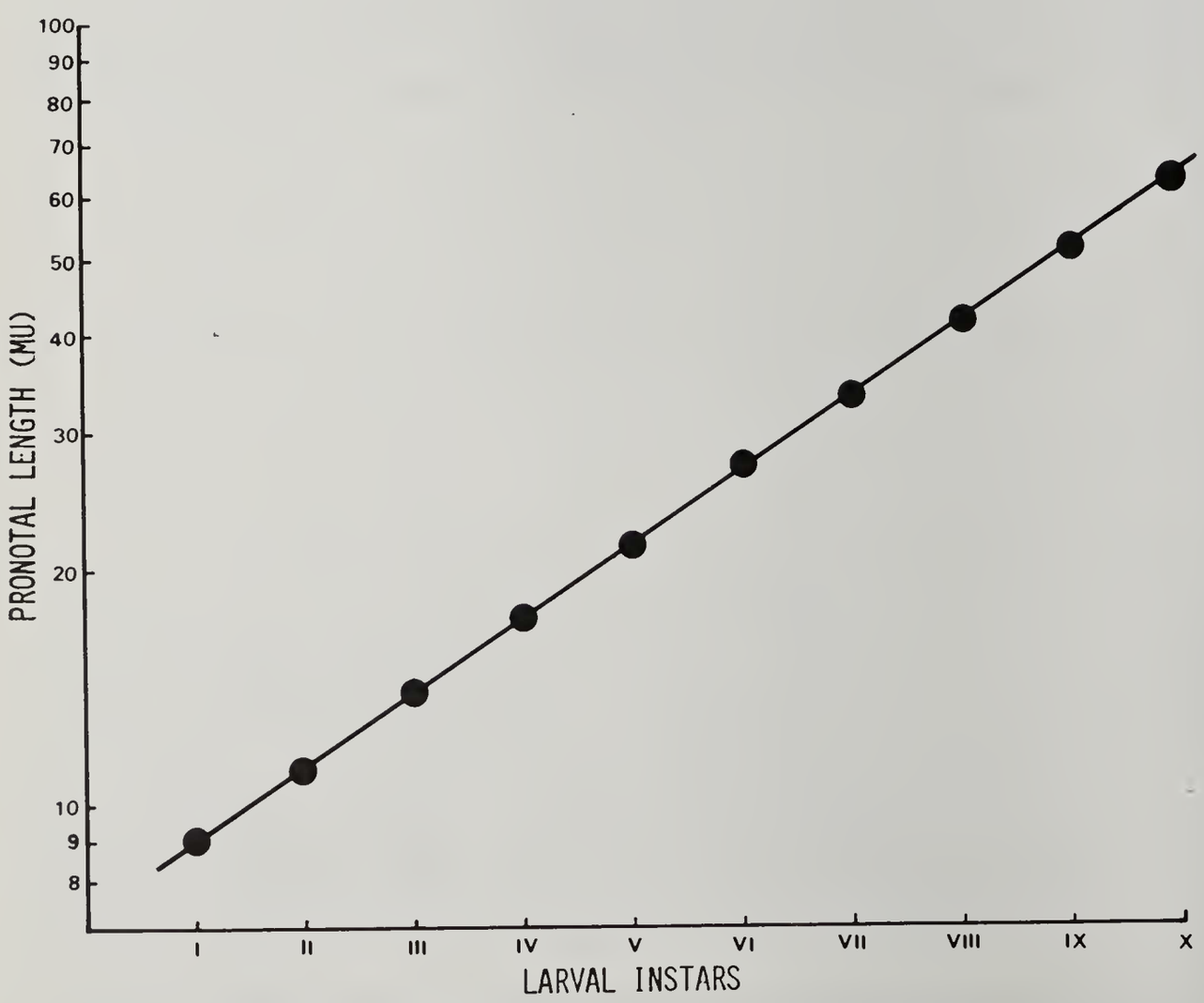

Fig. 3. Growth of prothorax in successive instars.

Pupae of *A. bicolor* have a behaviour nearly identical to that of elmid pupae (LeSage and Harper 1976); both pupate out of water under decaying vegetable materials along banks of streams, and both build a pupal chamber. The pupal period lasts probably 2 to 4 weeks from mid-June to mid-July.

Very few adults were collected in the field as they are nocturnal. Three were captured during the day under leaf litter along the stream; others were attracted to lights at night. The extreme dates of capture are June 27 (day) to July 24 (night). Mating and ovipositing have not been observed, but we assume that they occur at the same period or a little later. This is one of the main differences between the life-cycle of *A. bicolor* and that of elmids, in which the adults wait a year before mating and ovipositing (LeSage 1976). Furthermore, adult elmids are aquatic and can be encountered all year long, whereas those of *A. bicolor* are terrestrial and are only found in late June to late July.

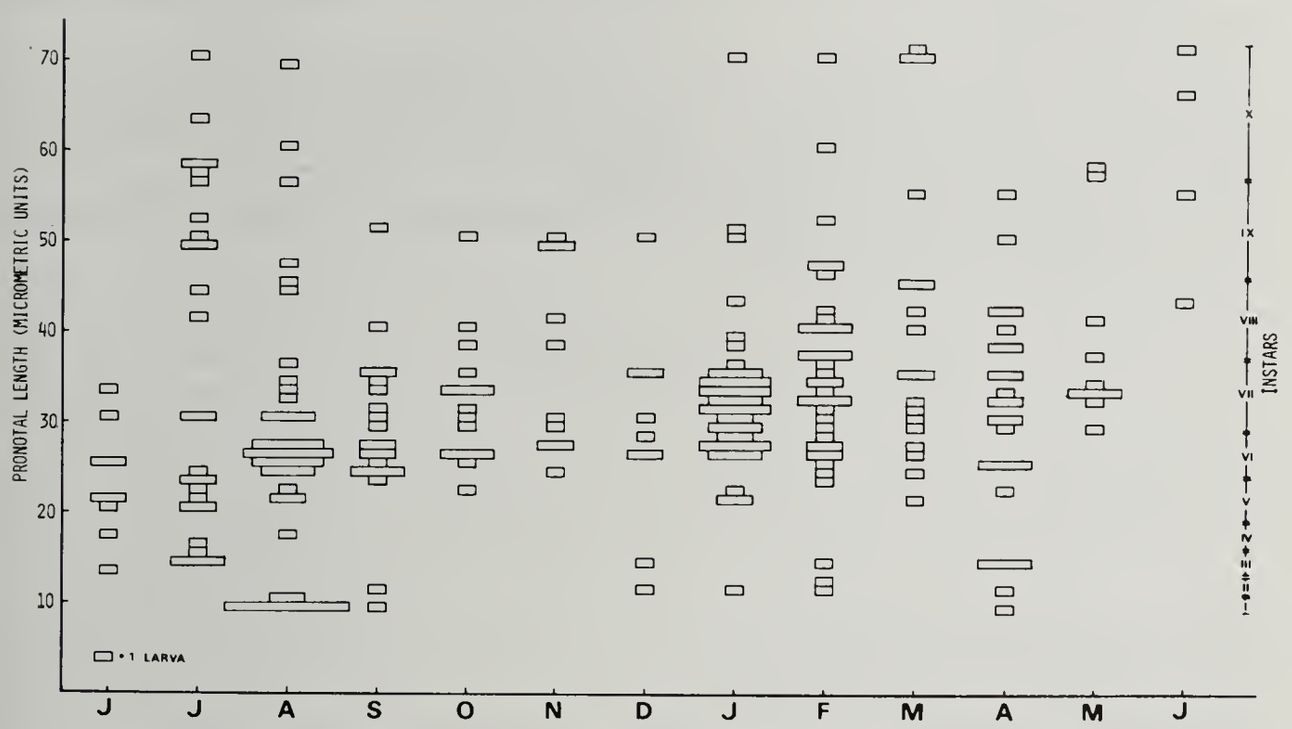

Fig. 4. Growth of larvae based upon frequency distribution of the pronotal lengths from June 1974 to June 1975 (in micrometric units, each equal to 0.02 mm). Total number of larvae: 278.

Acknowledgments

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References

Berthélemy C. and J. de Riols 1965. Les larves d'*Elmis* du groupe d'*E. maugetii* (Coléoptères: Dryopoidea). Ann. Limnol. 1:21-38.

Bertrand, H. 1972. Larves et nymphes des Coléoptères aquatiques du globe. Abbeville, F. Paillart, 804 p.

Böving, A. G. and F. C. Craighead 1931. An illustrated synopsis of the principal larval forms of the order Coleoptera. Ent. Amer. 11:1-351.

Brown, H. P. 1972. Biota of freshwater ecosystems identification manual. No. 6- Aquatic dryopoid beetles (Coleoptera) of the United States. U. S. Environmental Protection Agency, 82 p.

Hinton, H. E. 1946. The "gin-traps" of some beetle pupae; a protective device which appears to be unknown. Trans. R. Ent. Soc. Lond. 97:473-496.

Hausen, J. F. 1893. A list of Coleoptera collected in the vicinity of St-Jérome, Québec. Canad. Rec. Sci. 5:41-63.

Hynes, H. B. N. The invertebrate fauna of a Welsh mountain stream. Arch. Hydrobiol. 57:344-388.

Leech, H. B. and H. P. Chandler 1956. Aquatic Coleoptera. Chapter 13 *in* Usinger, R. L. (ed.), "Aquatic Insects of California". University of California Press, Berkeley, 508 p.

Leech, H. B. and M. W. Sanderson 1959. Coleoptera. Chapter 38 *in* Edmondson, W. T. (ed.), "Freshwater Biology". 2nd ed., Wiley New York, 1248 p.

LeSage L. and P. P. Harper 1975. Les Dryopoïdes aquatiques du Québec (Coléoptères). Ann. Soc. Ent. Québec 20:157-168.

LeSage, L. and P. P. Harper 1976. Description de nymphes d'Elmidae néarctiques. Can. J. Zool. 54:65-73.

LeSage L. 1976. Cycles biologiques de cinq espèces d'Elmidae. University of Montreal; M. Sc. thesis.